

# Hanford Tank Farms Vadose Zone Monitoring Project

## Preventive Maintenance Plan for the Radionuclide Assessment System

January 2006



U.S. Department  
of Energy



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**Preventive Maintenance Plan for  
the Radionuclide Assessment System**

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Prepared for  
U.S. Department of Energy  
Office of Environmental Management  
Grand Junction, Colorado

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Approved for public release; distribution is unlimited.  
Work performed under DOE Contract No. DE- AC03-02GJ79491.

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## **Hanford Tank Farms Vadose Zone Monitoring Project Preventive Maintenance Plan for the RAS**

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# 1.0 Introduction

During fiscal year (FY) 1995, the U.S. Department of Energy Grand Junction Office (DOE-GJO) was tasked to review the methods used at Hanford to detect leaks from individual single-shell tanks (SSTs). On the basis of this review, it was determined a medium-resolution spectral gamma logging system was needed to provide external monitoring of tanks that would supplement the in-tank leak detection being conducted. During FY 1996, DOE-GJO designed and fabricated the Radionuclide Assessment System (RAS) specifically for performing routine monitoring. The objective of the design was to deliver a logging system capable of obtaining measurements over the wide range of radionuclide concentrations expected around the SSTs. The RAS was initially constructed to perform logging in 1996, but funding was discontinued. Once the Hanford tank farms vadose zone baseline characterization was completed in FY 2000, DOE-GJO was tasked by the U.S. Department of Energy Office of River Protection (DOE-ORP) to complete the deployment of the RAS and initiate a monitoring program. As the Technical Assistance Contractor for DOE-GJO, S.M. Stoller Corp. (Stoller) is responsible for planning and performing the vadose zone geophysical monitoring tasks from its Hanford Office, with technical and administrative support from the Grand Junction Office.

The RAS consists of a standard-sized, 2002 Chevrolet 2500 HD 4X4 diesel pickup truck (E-37912, HO-1H-877) that has been fitted with a camper shell equipped with side storage boxes. The truck is powered by a V-8 diesel motor and will be operated with standard and usual motor vehicle operating procedures. Section 2 of the *Radionuclide Assessment System Logging System Operating Procedures* (DOE 2003) provides a description of the system components.

## 1.1 Purpose

Because the RAS is expected to operate on a daily basis, implementation of a preventive maintenance program is necessary to assure the longevity of vehicle and system performance. This preventive maintenance procedure assigns responsibility for maintenance and Point of Contact (POC) in the event problems are encountered. Major system components and the associated manufacturers' operational and maintenance manuals are identified and evaluated for applicability. A final purpose is to provide for a record keeping system to document inspections and maintenance events.

## 1.2 Objective

The overall objectives of the preventive maintenance program are to minimize breakdowns of the motor vehicle and system components and to assure safe operation. By providing proper maintenance of equipment and methods to identify minor problems before they become major issues are integral parts to an effective program. Provisions are made in the procedure for routine inspections, routine maintenance schedules, and the collection of data that document the effectiveness of the program and provide a comprehensive history of all problems and corrective measures associated with the RAS.

Maintenance schedules presented in this procedure reflect manufacturers' recommendations. These recommendations assume a level of service more strenuous than currently planned. Stoller

may decide to modify the service intervals with no loss of reliability or longevity. The Stoller Project Manager must approve revisions to this procedure before implementing the revision. Revisions may be made via a pen and ink change to this plan and in conjunction with a memo to the recorded and involved parties.

## 2.0 Responsibilities

This procedure is part of the equipment maintenance records that will be kept at the Stoller office with the other program files. Maintaining the RAS can be separated by two general categories identified as either the motor vehicle or the logging system. DOE-ORP has given the responsibility for the RAS to Stoller for all maintenance and repair activity. To accomplish this task, Stoller will rely on various qualified Hanford Site Contractor (HSC) personnel and organizations for support services.

All qualified drivers will be responsible for completing the *RAS Daily Inspection Record* (Figure 2-1) and performing pre-trip inspections (Section 4.2). The 200 East Area Garage will perform general motor vehicle maintenance, repair, and inspections. Stoller will perform logging system maintenance, repair, and inspections. Responsibilities that are more specific are listed below.

Stoller will be responsible for:

### Motor Vehicle

- Supplying, reviewing, and filing the *RAS Daily Inspection Record*.
- Tracking and scheduling routine maintenance.
- Scheduling non-routine repair if motor vehicle breakdown occurs.

### Logging System

- Maintaining and repairing the hardware and software components, including but not limited to the Mount Sopris winch and controller, sondes, logging cable, mast, computer, and the Leak Verification and Monitoring Logging Program (LVMON).
- Collecting the annual RAS calibration measurements.

Qualified HSC persons will be responsible for:

### Motor Vehicle

- Completing the *RAS Daily Inspection Record*.
- Performing daily pre-trip vehicle inspections and maintaining vehicle fluid levels.
- Operational checks – at each fuel fill up and monthly outlined in this procedure.
- Reporting vehicle problems or other off-normal conditions for repair to the POC.

### Logging System

- Operating the RAS for collecting spectral gamma-ray data from boreholes surrounding the SSTs in the Hanford tank farms.
- Reporting logging problems or other off-normal conditions for repair to the POC.

## RAS Vehicle Daily Inspection Log

This Inspection Log may be duplicated as necessary.

| Date | Mileage | Engine Run Hrs | Engine Fluids Check (✓) | Under Hood Inspection (✓) | Walk Around Vehicle Inspection (✓) | All Lights (✓) | RAS Vehicle Operator Signature |
|------|---------|----------------|-------------------------|---------------------------|------------------------------------|----------------|--------------------------------|
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |
|      |         |                |                         |                           |                                    |                |                                |

**Discrepancies and Deficiencies:** (More space is available on back of Inspection Log.)

Figure 2-1. RAS Daily Inspection Record

## 3.0 RAS System Information

### 3.1 RAS Fact Sheet

|   |  |               |                            |
|---|--|---------------|----------------------------|
| <b>Vehicle:</b>                                 | 2002 Chevrolet 2500 HD LS Club Cab 4X4 w/Duramax Diesel  |               |                            |
| <b>License Number:</b>                          | E-37912, U.S. Government   |               |                            |
| <b>Vehicle Identification No. (V.I.N.):</b>     | 1GCHK23162F238853  |               |                            |
| <b>Hanford Identification No.:</b>              | HO-1H-877  |               |                            |
| <b>Gross Vehicle Weight Rating (GVWR):</b>      | 9,200 lbs.   |               |                            |
| <b>Gross Axle Weight Rating Rear (GAWR RR):</b> | 6,084 lbs.   |               |                            |
| <b>Gross Actual Load:</b>                       | 7,820 lbs.   |               |                            |
| <b>Gross Actual Load Front:</b>                 | 4,040 lbs.   |               |                            |
| <b>Gross Actual Load Rear:</b>                  | 3,780 lbs.   |               |                            |
| <b>Winch:</b>                                   | Mount Sopris Instrument Co., Series MNA 10   |               |                            |
|   | Rated power supply: 0.75 horsepower  |               |                            |
|   | Drum size: 18-in. flange diameter, 10.5-in. barrel length  |               |                            |
|   | Load rating: 570 lbs.  |               |                            |
|   | Cable speed, max: 22 ft per minute   |               |                            |
| <b>Cable Length:</b>                            | 500 ft   |               |                            |
| <b>Cable Diameter:</b>                          | 0.25 in., 7 conductors, armored  |               |                            |
| <b>Cable Breaking Strength:</b>                 | 5,800 lbf  |               |                            |
| <b>Cable Weight in Air:</b>                     | 108 lb/1,000 ft  |               |                            |
| <b>NaI Probes:</b>                              |  |               |                            |
| Detector Name                                   | <u>Large</u>   | <u>Medium</u> | <u>Small</u>               |
| Crystal Size <sup>1</sup> (in.)                 | 3 x 12   | 1.5 x 2       | 1 x 1                      |
| Shielding                                       | None   | None          | 2 in. lead above and below |
| Diameter (in.)                                  | 4  | 3             | 3                          |
| Length <sup>2</sup> (in.)                       | 60   | 52            | 52                         |
| Weight <sup>2</sup> (lbs)                       | 56.75  | 32.25         | 43.25                      |
| Detector Resolution <sup>3</sup>                | < 8%   | < 8%          | < 8%                       |
| <b>KUTh Field Verifier:</b>                     | AEA Technology QSA, Inc., part no. 188701, serial no. 134  |               |                            |
| <b>Source Strength:</b>                         | 2.453 μCi (1.662 μCi <sup>40</sup> K, 0.46 μCi <sup>238</sup> U, and 0.331 μCi <sup>232</sup> Th)<br>11.7% potassium, 80 ppm <sup>238</sup> U, and 180 ppm <sup>232</sup> Th |               |                            |
| <b>Weight:</b>                                  | 64 lbs.  |               |                            |
| <b>Computer:</b>                                | Gateway Corporation, Solo 5300 notebook  |               |                            |
| <b>Zip Drive:</b>                               | Iomega 250 MB  |               |                            |
| <b>Power Inverter:</b>                          | Statpower Technologies Corporation, ProSine 1000/1800  |               |                            |
| <b>Fire Extinguisher:</b>                       | One, 10-lb., Type ABC, dry chemical  |               |                            |

<sup>1</sup> Units of diameter by length in inches

<sup>2</sup> Length and weight of entire sonde, including PHA/Telemetry Section

<sup>3</sup> At 662 keV

### 3.2 Motor Vehicle Identification

The RAS vehicle consists of a 2002 Chevrolet 2500 HD LS Club Cab 4X4 w/Duramax Diesel V-8 motor and automatic transmission. Additional specifications are available in the *2002 Duramax Diesel Engine Owner's Manual Supplement for Trucks*. This owner's manual is on file at the Stoller office for reference and will not be reproduced in this procedure. This vehicle is legally identified by the information presented in the following table:

| Parameter    | Identification Code |
|--------------|---------------------|
| V.I.N.       | 1GCHK23162F238853   |
| License No.  | E-37912, U.S. Govt. |
| Hanford I.D. | HO-1H-877           |

### 3.3 Basic Motor Vehicle Maintenance Material

The parts and supplies listed below reference the basic maintenance materials that are consumed during normal vehicle operation.

- Engine oil: 15W-40, API Service CG-4 or CH-4, synthetic-based
- Engine coolant: GM DEX-COOL™ (orange colored, silicate-free)
- Automatic transmission fluid: DEXRON™ III
- Power steering fluid: GM power steering fluid
- Front Axle: SAE 80W-90 Axle Lubricant
- Rear Axle: SAE 75W-90 Synthetic Axle Lubricant
- Air filter: A1618C
- Oil filter: PF2232
- Fuel filter: GM Part No. 97256734
- Serpentine belt: NBH25-061203
- Batteries: Type 78A-72, quantity (2)
- Tires: LT245/75R16E
- Fuel: Number 2-D diesel fuel year-round

Nominal fluid capacities are presented in the table below.

| Parameter           | Capacity    |
|---------------------|-------------|
| Crankcase w/ filter | 10.0 quarts |
| Cooling system      | 21.8 quarts |
| Fuel                | 34 gallons  |

## 4.0 Motor Vehicle Driver Inspections and Reporting

Driver inspections and reporting will be used to schedule regular vehicle maintenance and report general vehicle condition to ensure vehicle safety and operation can be maintained.

### 4.1 RAS Daily Inspection Record

Qualified persons who drive the RAS are responsible for completing the *RAS Daily Inspection Record* (Figure 2-1). This is a record of the engine hours, odometer mileage, and observations made from pre-trip inspections spanning a 2-week period. A clipboard will be used to hold and store this information. A driver's signature is required to complete the information reported on the *RAS Daily Inspection Record*. At the end of two weeks, the Stoller POC will collect the *RAS Daily Inspection Record*, review, and file it at the Stoller office.

### 4.2 Daily Pre-Trip Inspections

Qualified persons who drive the RAS are responsible for performing a daily pre-trip inspection. Drivers shall report as part of the pre-trip inspection their observations as to the safety and condition of the motor vehicle on the *RAS Daily Inspection Record*. A pre-trip inspection should include, but is not restricted to the following observations:

- Windshield, windshield wipers, and glass
- Rear vision mirrors, horn
- Tires, wheels, and rims
- Headlights, lights, and turn signals
- Parking (hand) brake
- Steering mechanism
- Vehicle body
- Underbody – check for leaks, broken, or damaged parts or wiring
- Under hood – check and fill fluid levels as necessary (cold engine conditions)
- Perform a 360° vehicle walk-around to ensure the vehicle is ready to move and no damage is evident
- Fire extinguisher check

Before driving, the driver shall be satisfied that the vehicle is in safe operating condition and has reviewed the last driver's vehicle inspection comments on the *RAS Daily Inspection Record*. A driver's signature is required to complete the *RAS Daily Inspection Record*.

Drivers will immediately contact the Stoller POC if any defects are found during the pre-trip inspections. The RAS shall not be driven or used if defects could affect the safety of the personnel, the motor vehicle, or components of the logging system.

### 4.3 Operational Checks At Each Fuel Fill

Qualified persons who drive the RAS are responsible for performing the following operational checks at each fuel fill to ensure the safety, dependability, and emission control performance of the RAS.

- Engine oil level check
- Engine coolant level check in the surge tank (do not open if motor is hot)
- Automatic transmission fluid level check
- Power steering fluid level check
- Windshield washer fluid level check
- Inspect hoses, belts, and all other under hood equipment
- Check for leaks

### 4.4 Operational Checks At Least Once a Month

Qualified persons who drive the RAS are responsible for performing the following operational check at least once a month to ensure the safety and dependability of the RAS.

- Tire inflation check

The following tire pressures are duplicated from the GM Certification/Tire Label located on the rear edge of the driver's door.

| Tire Pressure Measured When Cold <sup>1</sup> |        |
|---|--------|
| Front   | 45 psi |
| Rear  | 80 psi |

<sup>1</sup>“Cold” means a vehicle that has been sitting for at least 3 hours or driven no more than 1 mile.

## 5.0 Motor Vehicle Maintenance Schedule and Reporting

Stoller will base maintenance schedules by referring to the following documents:

- *RAS Daily Inspection Record*
- *2002 Duramax Diesel Engine Owner's Manual Supplement for Trucks*
- Code of Federal Regulations Title 49, part 396

Maintenance will be based on the following assumptions:

Intervals for regular engine maintenance will be determined using engine hours by multiplying engine hours by 40 to convert them to miles (this assumes an average speed of 40 miles per hour).

- Intervals of regular vehicle maintenance, other than engine maintenance, will be determined by odometer mileage.
- The maintenance schedule will follow the "short trip" definition for diesel engines found in the *2002 Duramax Diesel Engine Owner's Manual Supplement for Trucks*.

### 5.1 Synthetic Engine Oil

Synthetic engine oil will be used to lubricate the diesel motor powering the RAS. The change from mineral to synthetic-based oil was performed at 203 hours.

The decision to change was made based upon the experience Stoller gained using synthetic oils while operating and maintaining two Ford F800 series Spectral Gamma Logging System (SGLS) vehicles over a 5-year period. Equipped with diesel motors, the SGLSs were operated daily under rigorous field conditions. Samples of the engine oil were routinely collected from both SGLS vehicles and analyzed. Results of those samples helped in extending oil change intervals and diagnosing engine wear.

The use of synthetic oil in the RAS requires that an engine oil sample be taken every 200-engine hours +/- 50 hours for the first operating year. From experience, it is anticipated that the motor oil change interval will be at 800 engine hours +/- 50 hours or once a year.

Synthetic engine oil sampling, engine oil, and filter changes will be performed according to the following schedule unless otherwise specified by a memo from the Stoller Program Manager:

- 200 engine hours +/- 50 hours for engine oil sampling and analysis for the first year of operation.
- 800 engine hours +/- 50 hours for engine oil and filter changes, plus a sample of engine oil for analysis.

Oil samples will be sent to a lab for analysis. Sample results will show if there is abnormal metal wear and/or changes in oil viscosity and composition affecting the motor. The analytical reports will be reviewed and kept as part of the permanent record.

Synthetic oil product specifications and Material Safety Data Sheets are kept on file in the Stoller office.

## **5.2 Annual Vehicle Inspection Report**

Once every year and/or during the 800-hour oil change, an Annual Vehicle Inspection will be performed conforming to 49 CFR 396. This inspection includes but is not limited to brake, exhaust, fuel and steering system checks, fluid-level checks, chassis lubrication, a safety check, and a road test (Figure 5-1).

## **5.3 Heavy Duty Alternator**

An additional alternator (140 amp CS-144, J/B64075), heavy-duty wiring harness, and associated brackets were installed on this vehicle to charge the sealed acid battery installed in the bed of the truck. This battery provides DC power to the inverter, which in-turn provides AC power to all the individual RAS components. This alternator is isolated from the trucks electrical system, which is run off the original factory installed alternator. A larger serpentine belt (NBH25-061203) had to be installed to compensate for the second alternator.

Other than the motor's serpentine belt and periodic inspections of the alternator wiring, alternator maintenance is not scheduled. Qualified persons operating the RAS monitor alternator output and load during logging using a liquid crystal display located in the logging cabin. Any power disruptions will be reported to the Stoller POC.

## **5.4 Portable Fire Extinguisher**

The RAS is equipped with one 10-lb., ABC-Rated, dry-chemical portable fire extinguisher. Access to the fire extinguisher is gained by opening the tailgate and camper shell widow located at the rear of the truck. The fire extinguisher is affixed to the wall inside the bed on the driver's side. Equipment or stored materials shall not block the portable fire extinguisher.

Stoller will ensure that the fire extinguisher meets the portable fire extinguisher inspection, testing, and maintenance program outlined in the *Fire Protection System Testing/Inspection/Maintenance, Deficiencies*, HNF-RD-7899, Revision 1. An inspection tag that is affixed to the fire extinguisher will be completed at monthly inspections.

| VEHICLE HISTORY RECORD |                   |
|------------------------|-------------------|
| REPORT NUMBER          | FLEET UNIT NUMBER |
| DATE                   |                   |

  

|   |   |
|---|---|
| MOTOR CARRIER OPERATOR  | INSPECTOR'S NAME (PRINT OR TYPE)  |
| ADDRESS   | THIS INSPECTOR MEETS THE QUALIFICATION REQUIREMENTS IN SECTION 396.19<br><input type="checkbox"/> YES                                       |
| CITY, STATE, ZIP CODE   | VEHICLE IDENTIFICATION (✓) AND COMPLETE <input type="checkbox"/> LIC. PLATE NO. <input type="checkbox"/> VIN <input type="checkbox"/> OTHER |
| VEHICLE TYPE <input type="checkbox"/> TRACTOR <input type="checkbox"/> TRAILER <input type="checkbox"/> TRUCK<br><input type="checkbox"/> (OTHER) | INSPECTION AGENCY/LOCATION (OPTIONAL)   |

| VEHICLE COMPONENTS INSPECTED |              |               |  |    |              |               |  |    |              |               |  |
|------------------------------|--------------|---------------|--|----|--------------|---------------|--|----|--------------|---------------|--|
| OK                           | NEEDS REPAIR | REPAIRED DATE | ITEM   | OK | NEEDS REPAIR | REPAIRED DATE | ITEM   | OK | NEEDS REPAIR | REPAIRED DATE | ITEM   |
|                              |              |               | 1. BRAKE SYSTEM  |    |              |               | 4. FUEL SYSTEM   |    |              |               | 9. FRAME   |
|                              |              |               | a. Service Brakes  |    |              |               | a. Visible leak  |    |              |               | a. Frame Members   |
|                              |              |               | b. Parking Brake System  |    |              |               | b. Fuel tank filler cap missing  |    |              |               | b. Tire and Wheel Clearance  |
|                              |              |               | c. Brake Drums or Rotors   |    |              |               | c. Fuel tank securely attached   |    |              |               | c. Adjustable Axle Assemblies (Sliding Subframes)  |
|                              |              |               | d. Brake Hose  |    |              |               | 5. LIGHTING DEVICES  |    |              |               | 10. TIRES  |
|                              |              |               | e. Brake Tubing  |    |              |               | All lighting devices and reflectors required by Section 393 shall be operable.   |    |              |               | a. Tires on any steering axle of a power unit  |
|                              |              |               | f. Low Pressure Warning Device   |    |              |               | 6. SAFE LOADING  |    |              |               | b. All other tires   |
|                              |              |               | g. Tractor Protection Valve  |    |              |               | a. Part(s) of vehicle or condition of loading such that the spare tire or any part of the load or dunnage can fall onto the roadway.                               |    |              |               | 11. WHEELS AND RIMS  |
|                              |              |               | h. Air Compressor  |    |              |               | b. Protection against shifting cargo   |    |              |               | a. Lock or Slide Ring  |
|                              |              |               | i. Electric Brakes   |    |              |               | 7. STEERING MECHANISM  |    |              |               | b. Wheels and Rims   |
|                              |              |               | j. Hydraulic Brakes  |    |              |               | a. Steering Wheel Free Play  |    |              |               | c. Fasteners   |
|                              |              |               | k. Vacuum Systems  |    |              |               | b. Steering Column   |    |              |               | d. Weeps   |
|                              |              |               | 2. COUPLING DEVICES  |    |              |               | c. Front Axle Beam and All Steering Components Other Than Steering Column  |    |              |               | 12. WINDSHIELD GLAZING   |
|                              |              |               | a. Fifth Wheels  |    |              |               | d. Steering Gear Box   |    |              |               | Requirements and exceptions as stated pertaining to any crack, discoloration, or loss of reducing material reference 393.60 for exceptions |
|                              |              |               | b. Pintle Hooks  |    |              |               | e. Pitman Arm  |    |              |               | 13. WINDSHIELD WIPERS  |
|                              |              |               | c. Drawbar/Towbar Eye  |    |              |               | f. Power Steering  |    |              |               | Any power unit that has an inoperative wiper or missing or damaged parts that render it ineffective  |
|                              |              |               | d. Drawbar/Towbar Tongue   |    |              |               | g. Ball and Socket Joints  |    |              |               | List any other condition which may prevent safe operation of this vehicle.   |
|                              |              |               | e. Safety Devices  |    |              |               | h. Tie Rods and Drag Links   |    |              |               |  |
|                              |              |               | f. Saddle-Mounts   |    |              |               | i. Nuts  |    |              |               |  |
|                              |              |               | 3. EXHAUST SYSTEM  |    |              |               | j. Steering System   |    |              |               |  |
|                              |              |               | a. Any exhaust system determined to be leaking at a point forward of or directly below the driver/sleeper compartment.   |    |              |               | 8. SUSPENSION  |    |              |               |  |
|                              |              |               | b. A bus exhaust system leaking or discharging to the atmosphere in violation of standards (1), (2) or (3).  |    |              |               | a. Any U-bolt(s), spring hanger(s), or other axle positioning part(s) cracked, broken, loose or missing resulting in shifting of an axle from its normal position. |    |              |               |  |
|                              |              |               | c. No part of the exhaust system of any motor vehicle shall be so located as would be likely to result in burning, charring, or damaging the electrical wiring, the fuel supply, or any combustible part of the motor vehicle. |    |              |               | b. Spring Assembly   |    |              |               |  |
|                              |              |               |  |    |              |               | c. Torque, Radius or Tracking Components   |    |              |               |  |

INSTRUCTIONS: MARK COLUMN ENTRIES TO VERIFY INSPECTION: **X** OK, **X** NEEDS REPAIR, **NA** IF ITEMS DO NOT APPLY. \_\_\_\_\_ REPAIRED DATE

CERTIFICATION: THIS VEHICLE HAS PASSED ALL THE INSPECTION ITEMS FOR THE ANNUAL VEHICLE INSPECTION REPORT IN ACCORDANCE WITH 49 CFR 396.

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ORIGINAL

Figure 5-1. Annual Vehicle Inspection Report

## 6.0 Logging System Maintenance

In general, the components that constitute the logging system on the RAS require very little maintenance. Individual components of the RAS can be separated as either being mostly electrical or mechanical according to their function. Operational checks and inspections of these components will be performed to maintain the operation and performance of the logging system.

- Mechanical components of the RAS include the winch, mast assembly, cable head, and logging cable. Mechanical components will be inspected for wear-and-tear, maladjustment, and repaired and/or replaced as necessary.
- Electrical components of the RAS include the power inverter, sonde (detector and telemetry section), winch motor, laptop computer, LVMON logging program, multifunction counter, data storage and retrieval unit. Electrical components will be observed for degradation of service, repaired and/or replaced as necessary.

A more detailed description of individual components that constitute the RAS is outlined in Section 2 of the *Radionuclide Assessment System Logging System Operating Procedures* (DOE 2005). A description of maintenance procedures and replacement history for several components is described below.

### 6.1 Mount Sopris Winch Maintenance

An electrically powered winch, manufactured by the Mount Sopris Instrument Company, is mounted in the bed of the RAS and is used to convey the sonde up and down borehole during data collection. This winch meets the definition of *Base Mounted Drum Hoists* as defined in The American Society of Mechanical Engineers Standard ASME B30.7-1994.

The Mount Sopris WN series winch has a 2-speed transmission, a manual disk brake, a tension sensor with automatic cutoff, and a liquid crystal depth/speed/tension display.

This winch system requires very little maintenance; however, qualified persons operating the winch should perform daily inspections including but not limited to the following:

- All control mechanisms for maladjustment or excessive wear interfering with logging cable removal or retrieval.
- Tension sensor for malfunction or damage.
- Logging cable for excessive wear or distortion.
- Electrical motor for malfunction or signs of excessive deterioration, and dirt and moisture accumulation.

Stoller personnel will be responsible for making any required repairs and/or modifications to the Mount Sopris winch system. They will also perform the required periodic maintenance. The periodic maintenance of the winch system includes cleaning and lubricating the following components:

- Ball screw
- Level wind carriage support shaft
- Drum
- Level wind chain

The Mount Sopris owner's manual and technical guide for the MN series winch, winch controller, including schematics, are on file at the Stoller office for reference and are not included in this document.

## **6.2 Mast Maintenance**

The mast utilizes two sheave wheels capable of conveying the logging cable through the boreholes. Qualified persons operating the RAS will routinely inspect the material and welds on the mast structure including the mast base, sheave wheels, adapters for cracks, and/or abnormal wear. Problems will be immediately reported to the Stoller POC.

The sheave wheels are fitted with oil impregnated bronze bushings. Stoller personnel will periodically lubricate the bushings with 30W oil.

## **6.3 Logging Cable and Cable Head**

The logging cable and cable head require very little maintenance. Qualified personnel operating the RAS should perform daily inspections of the logging cable and cable head noting the cable's general condition. Worn or kinked cable should be reported to the Stoller point of contact. Threads and "O" ring seals on the cable head should be routinely cleaned and kept lightly lubricated with Lubriplate (white) grease.

### **6.3.1 Cable Re-Heading**

Stoller personnel will be responsible for re-heading the logging cable and making any other repairs to the logging cable or cable head as needed. Periodic maintenance will include the re-heading of the logging cable prior to the annual RAS calibration or when a cable head problem is identified.

Guidelines for re-heading the logging cable are on file at the Stoller office for reference and are not included in this document.

## 6.4 Logging Sondes

The RAS uses three sodium iodide (NaI) detectors that are individually connected to a common telemetry section; detector and telemetry sections combined constitute the logging sonde. The logging sondes require very little maintenance. Qualified persons operating the RAS should handle these tools with care to prevent damage to the internal electronics and NaI crystals. All exposed threads and “O” ring seals should be routinely cleaned and kept lightly lubricated with Lubriplate (white) grease. The exposed slip ring contacts on the bottom of the telemetry section and the pin-type contacts on the top of the detector sections should be routinely inspected for damage and cleanliness.

### 6.4.1 Detector Disassembly and Assembly

Stoller personnel will be responsible for all detector disassembly, assembly, maintenance, and repairs. Each time a detector is dismantled, the internal threads and “O” ring seals on the cap and housing will be thoroughly cleaned and lightly lubricated with Lubriplate (white) grease. The threads are fine and can easily be cross-threaded.

Two adjustable chain-type wrenches are the preferred tools when removing or joining sections of the sonde. Position one wrench around the housing cap to be removed. Caps are located on the top and bottom of the telemetry section and on the top of the small and medium detectors. Locate the other wrench at least 3 in. below the joint between the housing and the cap being removed. When the wrenches are located in these positions, compression of the fine threads and binding around the cap are prevented.

Internally, the electrical components in the telemetry section and in the small and medium detectors are mounted as a rigid one-piece unit in Lucite carriers. These rigid fixtures are affixed to the caps by small setscrews. When turning a cap, the Lucite carrier (and electronics) also turns. When removing a cap, the Lucite carrier and cap are removed as a unit.

The large detector’s cap is affixed to the housing with six 8-32 socket-retaining screws. Dismantling this detector requires removing these screws and gently removing the cap, being careful not to damage the “O” ring seal glands. When removing the housing cap, an extra 10 in. of wiring harness connects the cap and the photo-multiplier tube. In the large detector, the internal components and the cap are not a rigid one-piece unit. With the cap off, slide the internal components from the housing.

Additional technical information regarding the repair of electrical components including schematics is found in the *1996 Draft Technical Guide, Revision 0* (DOE 1996). This guide is on file at the Stoller office for reference and is not included in this document.

## 7.0 Glossary

**Qualified Driver:** A person who possesses a valid driver's license and is familiar with operating a diesel-powered motor vehicle.

**Qualified Person:** A person who has been trained by Stoller to collect spectral gamma-ray data while operating the RAS.

## 8.0 References

American Society of Mechanical Engineers (ASME), *Base Mounted Drum Hoists*, ASME B30.7-1994, 1994.

*Federal Motor Carrier Safety Regulation, Code of Federal Regulations Title 49, Parts 40, 235, and 355-399*, October 2000.

*Fire Protection System Testing/Inspection/Maintenance, Deficiencies*, 2002, HNF-RD-7899, Revision 1.

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U.S. Department of Energy (DOE), 1996. *1996 Draft Technical Guide, Revision 0*, prepared by RUST Geotech for the Grand Junction Projects Office, Grand Junction, Colorado.

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